

# Aviation Week & Space Technology

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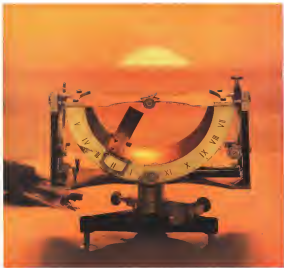
Mid-December, 1963

**Buyers  
Guide  
Issue**

Titan 2 Silo Launch







Wheeler Solar Chronometer for astronomical observations. Designed by the AC in 1940's. Rebuilt.

## from solar chronometer to space booster guidance

The Wheeler Solar Chronometer was designed to infer the true sun time and longitude, with corrections for the sun's and the earth's position. Highly accurate, though it was, the instrument had the drawback of all sun data: it was utterly worthless when the sun went down.

To avoid the possibility of being in the earth's shadow, space launch vehicles require guidance systems capable of determining positional fixes without solar-aided values. This requires advanced navigational systems of unparalleled accuracy—AC accuracy.

AC is presently modifying its Titan III inertial guidance system for application in the Titan III. And AC has recently been selected to produce the navigation guidance system for NASA's Apollo command module. Added to these current programs, AC's outstanding performance on the Thor, Nike, Regulus and Polaris

missile programs and its work in providing navigation equipment for manned aircraft have established AC as a leader in the field of navigation and guidance.

AC's ability to design, develop and produce highly accurate guidance and navigation systems all over the world is unique. Put it to work for you. Contact: Director of Sales, AC Spunk Plug Division, General Motors, Milwaukee 2, Wisconsin.



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\*Hoses measured in feet excepted.

SUPER "T-HF" TEFLON 12000 P.S.I. SF 156 Hose Assembly	SUPER T TEFLON 12000 P.S.I. MS 26750 Hose Assembly	HIGH DENSITY POLYETHYLENE 12000 P.S.I. MS 26750 Hose Assembly	TEFLON AND GIL 12000 P.S.I. MS 26750 Hose Assembly
113026-6-L 1" (113") Hose up to 60% lighter than conventional MIL-H-8794	112-312-312-5-L MS 26750 Hose Assembly MIL-H-8798 Hose	112-312-312-5-L MS 26750 Hose Assembly MIL-H-8798 Hose	112-312-312-5-L MS 26750 Hose Assembly MIL-H-8798 Hose
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**SPECIAL CONFIGURATIONS**  
Stratoflex has a lot of the many different configurations. Stratoflex has supplied in military.

Write for Stratoflex Aircraft & Missile Catalog, Super "T-HF" Teflon catalog 5-1 or Super T Teflon catalog 5-2

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TOTAL PERFORMANCE of military aircraft and missile systems depends on **exceptional** performance and reliability. For rotary power functions, hydraulic damping and vibration control, leading airframe and missile contractors specify Houdaille hydraulic equipment.



**FLUTTER DAMPERS** — As original Houdaille design, these compact rotary vane type dampers offer the best solution to high frequency vibration problems on aircraft control surfaces. Applications include the Republic F-105 and McDonnell's F-4H and F-101.



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**CONTROLS DAMPERS** — For a variety of control system applications, these specially engineered units provide positive hydraulic damping for such functions as elimination of stick vibration and feedback, and limiting of pilot control input. Shown are the stick damper for the Kaman HU2-K and other typical designs.



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WHETHER YOUR PROBLEMS involve airborne hydraulic applications or ground handling systems, look to Houdaille for the answers. Write for our descriptive booklet showing Houdaille's complete facilities and products, or send details of a specific problem to . . .



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# Two ways to get aerospace workstands and scaffolding:

1

First find someone locally who can recommend and design custom-made equipment that fills your needs. Someone with plenty of aerospace experience, who can really understand your problem. This may take a few weeks and cost plenty. Then find an outfit who can fabricate the scaffolding, or hire the people yourself and buy them all the equipment they'll need. This may take another few months, and it could cost a fortune. Then, after a few tries and some backing and filling, you'll get some workstands or scaffolding you can depend on. Maybe.

2

Call Patent Scaffolding's Aerospace Division.



Call us and you'll get exactly what's needed, fast—at lowest possible cost. Send for a copy of our booklet showing a dozen typical aerospace jobs we've done lately, from missile access platforms to special submarines and radome erection scaffolding, from aircraft workstands to recovery towers. Bulletin G236 is yours for the asking.

**PS6** AEROSPACE DIVISION  
THE PATENT SCAFFOLDING CO., INC.  
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- Accuracy: 1% and 0.1%
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- -55°C to +100°C Operating
- Seal tested by MIL-STD



### MILLIWATT MEMORY:

- 120 to 512K bits equivalent in 16 bit word type
- Multiple bit address or data with power failure
- 1 — 8 individual memory pages
- An input as 10 extra inputs
- Read/Write (not Read/Write/Write/Write) Data/Write or Read/Write/Write/Write
- On-board code
- -55°C to +100°C Operating
- Seal tested by MIL-STD



### MILLIWATT INTERVALOMETER:

- 12 semiconductor gates — with each built in silicon 8 chips
- Pulse output per event, 10 relay test to 10,000 cps with 100 ns resolution
- 10,000 cps with 10 ns resolution
- 10,000 cps with 10 ns resolution
- 10,000 cps with 10 ns resolution
- 10,000 cps with 10 ns resolution
- 10,000 cps with 10 ns resolution
- 10,000 cps with 10 ns resolution

**HISTORY:** NO ONE (except, no one) comes close to matching DI/AN's history of reliability in magnetic logic equipment for space. Proof: The operating history of these devices (first their predecessor) approaches a million hours in over 30 different aerospace programs with no known failure.

**RELIABILITY:** This, mind you, is a record of actual use of our clocks, timers, counters, memory memories, etc. The record is supported by two life tests of the individual magnetic Core Transistor Logic modules (CTL's), with which these equipments are made. The tests have logged 30 million module hours over 5 years — no failures, and 150 million module hours over 2 years — no failures. These numbers are for complete logic elements — but compare them with numbers for single components.

**THE KEY:** to this history and reliability: The unique radical logic inherent in CTL magnetic logic design: low power,

few components, non-critical semiconductor parameters, no incremental flow states, resistance to radiation and to extreme temperatures. Plus, extraordinarily high fully-clocked circuit density (over 10,000 high logic power CTL's per cubic foot) 1000 CTL's make a parallel GP computer.

**SHORT DELIVERY:** One type of magnetic logic element is used for all functions — function determined by interconnections. New equipments are built with almost no electronic engineering time required. Product line units that stand above are available on short delivery from current production.

**WRITE FOR DATA SHEETS** and special report on "MAGNETIC LOGIC IN SPACE — A REPORT ON HISTORY AND RELIABILITY."

**ALSO AVAILABLE:** Literature covering three other DI/AN product areas: Magnetic Logic and Register Modules and cards • Standard Core Memories • Data Systems

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CORPORATION  
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APEX Military Universal Joints are built to conform with and exceed all requirements stipulated in Spec. MIL-J-8000A, Class 2, Standard Drawing MS-20271 (Heavy Duty) and Class 1, Standard Drawing MS-20270 (Light Duty), as indicated in Qualified Products List (QPL-61963). SPECIAL WARNING: JOINTS IN AIR CIRCUMSTANCES MUST BE MAINTAINED TO EXACT SPECIFICATIONS.

# APEX

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High axial and torsional strengths.  
High strength-weight ratio per dia.  
Minimum maintenance attention.  
No replacement during anticipated service life of airplane on most applications.  
High mechanical efficiency, low wear.  
Low torsional deflection.  
Not adversely affected by breathing or fret corrosion under shock loads or vibration, or by operating overloads.

Removal Size: 3/8" THROUGH 1 1/2"

### PERMANENT LUBRICATION

Working parts enclosed in covers especially adapted for service in heat, cold, water, oil, etc.  
SEALERS, LUBRICANT-SEALING COVERS provide a supply of lubricant in excess of actual requirements, for long service periods.  
dirt, water lubricating film in bearings.  
Provide high resistance to vibration, after vibration dampening.  
Prevent heat dissipation; eliminate corrosion.

WRITE FOR CATALOG 38

# APEX

General Metals Corporation  
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## UNIVERSAL JOINTS and ASSEMBLIES



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They are all products of the world's leading filament winding facility. A pre-programmed hydraulic servo mechanism is the basis of the ES&B developed filament winding machines which ensure maximum tolerances and assure repeatability and reliability. Assembly times are fast free. Temperatures and humidity are rigidly controlled. Extreme versatility eliminates size limitations previously imposed on filament wound structures.

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Industrial Air Park, Ardmore, Oklahoma

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TYPE 1307 FUEL CONTROL IS

# HIGH

IN RELIABILITY,  
PERFORMANCE



# YET— LOW IN WEIGHT AND COST

An aircraft speeds into the supersonic and beyond Mach 2, engine control needs become more and more critical and exacting. The J-75 engines on the record-setting F-4H aircraft have Woodward controls which quickly and accurately sense and act upon the slightest input variation. Type 1307 Fuel Control on the F-4H is a striking example of the capability of a compact precision control to meter fuel precisely under swiftly changing conditions. Write to Woodward for your aircraft governor needs.

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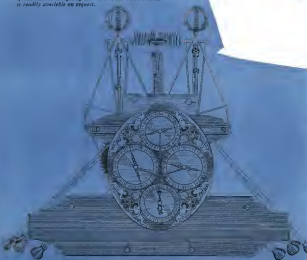
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largest manufacturer  
of prime mover  
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HARRISON'S CHRONOMETER *Marine Timekeeper No. 1*, awarded 1735 for determining longitude functioned within an error of three seconds per day. This is one of a series commissioned by the Canadian Marine Company. A printed reproduction of this historic navigating instrument, size 11 x 14 inches is readily available on request.



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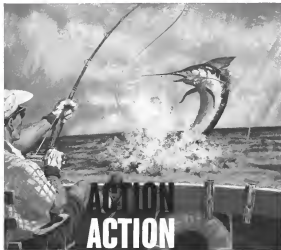
## 228 years before DOPPLER

Between the chronometer and Doppler lie 228 years of man's attempt to mark an accurate track of his coming and going over the earth, and of his immediate position on its surface. Canadian Mercator Doppler provides a new measure to the navigator's art preceded by the sextant for latitude, compass for direction, sextant for position and chronometer for time. With its compass, CMCC Doppler gives the art all these simultaneously, without human error. In the most accurate and reliable system used today CMCC designs and manufactures Doppler for "H" and "J" bands, Lat/Long and Along and Cross Track Computations, as well as indicators. CMCC Doppler is applied to commercial transport, aerial survey, military transport, anti-submarine warfare, helicopters, V/STOL aircraft and supersonic aircraft.



Doppler Computer Console





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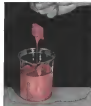
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What you can do with General Electric's versatile **RTV silicone compounds** to insulate, seal and mold from  $-150^{\circ}\text{F}$  to  $500^{\circ}\text{F}$



**Seals and molds it.** Fluid RTV silicone rubber granules dry into translucent solids. RTV has excellent dielectric strength and generally no shrinkage. Cure time at room temperature can be varied from minutes to hours.



**Paints it.** Transparent or opaque, GE silicones provide a moisture protective, abrasion resistant, flame, thermal and mechanical shield. Flows freely around complicated parts, can be cut away to replace internal components.



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**Seals it.** Bendable RTV (other surface is generally rigid) undergoes expansion and contraction, stress and chemicals. Can be used for sheet metal fabrication, duct sealing, gasketing. Viscometer range from viscous to paste.



**Insulates it.** Adhesive/condensate RTV-150 requires no mixing or catalyst, can be used in condensation wiring. For on design caulking along and welding. RTVs are virtually ageless, will not stain, crack or weather.



**Manufactures it.** RTV adhesives/bondants are fast curing, extremely tough, flame resistant, resistant parts to most acids, bases, common solvents. Have an RTV adhesive formulates flexible non-rings to form cylindrical ducts.

If you would like a free sample of one of the nine General Electric RTV silicones for evaluation, write us your letterhead, describing your application. For additional information, check reader service card. Section J125, Silicone Products Dept., General Electric Company, Waterford, New York.

**GENERAL ELECTRIC**

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Solid state d-c amplifier  
100-watt d-c output

For complete data write Inland, Dept. 9-4.

REPRESENTATIVE RANGE OF INLAND D-C TORQUE MOTORS

TYPE	PEAK TORQUE AT STALL LB-FT	POWER INPUT FOR PEAK TORQUE WATTS @ 25°C	SHUN- TING LEADS INCHES	G.B. THERMIST
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T 0126	20 lb-ft	42	2.81	.40
T 0101	10 lb-ft	32	2.81	1.00
T 2207	95 lb-ft	79	3.79	1.00
T 4006	1.0 lb-ft	100	5.13	1.95
T 0109	2.7 lb-ft	86	6.26	1.26
T 0701	7.0 lb-ft	248	7.25	1.43
T 0702	11.0 lb-ft	327	9.00	1.63
T 0901	20 lb-ft	626	10.50	3.83
T 0902	30 lb-ft	690	12.69	4.30
T 0904	100 lb-ft	1830	12.76	6.75
T 10002	300 lb-ft	1380	16.63	6.92
T 0004	900 lb-ft	4120	25.50	10.58
T 0001	1000 lb-ft	7400	45.0	10.25

For complete data on these or other Inland d-c torque motors, address Dept. 9-4, Inland Motor Corporation of Virginia, Warrenton, Massachusetts.

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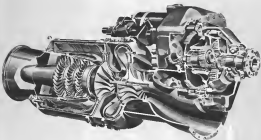


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## TURBOPROP ENGINE FOR LIGHT AIRCRAFT AIRESEARCH MODEL 331



This 600 horsepower turboprop engine is designed to power the new generation of light, fixed wing aircraft for both civil and military applications. • The Garrett/Airesearch TP331 has a specific fuel consumption of 68 pounds per shaft horsepower-hour, and a weight to power ratio of .45 pound per horsepower. The engine has a response rate from flight idle to full power of approximately 1/3 of a second. A military version has been designated the TM by the U.S. Navy. • Designed specifically as a prime power plant, the model 331 is backed by the company's experience in producing over 10,000 gas turbine engines. A unique oil/gearbox permits flexibility of application while a straight forward induction system minimizes installation costs. Opposite exhaust rotation can be made available, and controls are adaptable for a prop governing, beta, or constant speed system. • The Model 331 engine is programmed for additional performance growth. The turbohell version (TSE-337) has been flight tested as a power plant in rotary wing and vertical lift vehicles.

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Models in bronze or stainless steel  
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Flows to 100 scfh  
Low torque 50 inch-lb. at 8000 psig  
Panel mounting  
Bulletin 642



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Models in bronze, stainless steel  
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Adjustable inlet ranges  
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to 2500-10 000 psig  
Bulletin 642



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Models in bronze, stainless steel,  
or aluminum  
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Flow 15 scfh  
Low torque 40 inch-lb. at 7 000 psig  
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**G600, G600R, AND G600A  
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Flows to 60 000 scfh  
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**LV LOADER VALVE**

Models in bronze, stainless steel,  
or aluminum  
Inlet and outlet 2000 psig  
Flow 10 scfh  
Fast bypass for control  
30° clockwise safety  
30° counter-clockwise, blocks  
Panel mounting  
Bulletin 635



**G600 AND G600A  
SERIES GAS O-RING REGULATORS**

Models in bronze  
Inlet and outlet range  
2500 to 10 000 psig  
Flows to 1000 scfh  
Remote control and/or  
panel mounting provisions  
Bulletin 641, 644, 645

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Regulators shown here are typical of the available models covering a range of pressures to 10,000 psig and capacities to 60,000 scfh at -67°F to +180°F. Other types, sizes and modifications for special applications available upon request. Write for Regulator Inquiry Form 301-6.



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SERVOLOC Series 1-8



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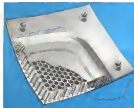
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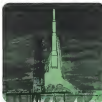
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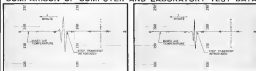
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## Message From the Publisher

### Industry's Endless Challenge

The aerospace industry is facing another year of technical and economic transition that will offer a substantial challenge to management. It has been a tradition of the aerospace industry, from the original Wright brothers factory in Dayton to the space age, that technology has forced changes almost faster than organizations—both industrial and political—have been able to absorb them. The penalties for those who have failed to perceive these changes have been severe. The rewards for those who have ridden the crest of expanding technology have been substantial.

The Bayern Guide must this year should provide the aerospace industry with some significant clues on what changes in procurement and technology portend for 1964 and beyond. The Fiscal 1965 budgets for the Defense Dept. and the National Aeronautics and Space Administration are now being hammered into their final form for presentation to the Congress next month. It is already clear that they will continue in extremely high level of activity across the entire spectrum of the aerospace technology. The pulse of the major ICBM programs such as Titan, Minuteman and Polaris, plus the acquisition of costly land-based and sea-launched submarines, have passed. But there will continue to be strong activity in developing improved propulsion, guidance, re-entry vehicles and command systems for advanced models of new ballistic missiles that can be accommodated in the vast complex of concrete sites and submarines already established. The biggest military procurement item will continue to be aircraft and their related equipment. It is significant that even when missile spending reached its peak in the years just past, it never equalled the steady level of aircraft procurement, and never even came close to splitting the market evenly as to more basic programs.

### Resurgence of Aircraft

The aircraft portion of the aerospace industry is headed for a period of lively technical development stimulated by accumulated technical neglect during the past several years and the development of a wide range of new military requirements for flying vehicles of all types. Those who abandoned aviation prematurely in the first flush of manufacturing new cars due to its aging age represent.

Space technology will continue to expand in both its NASA and military phases, with additional impact from the growing international realization that no nation can play a significant role in the world tomorrow without a sound capability of its own in the science and industry of space.

The greatly expanded Products and Services section of the Bayern Guide must now list more than 4,000

manufacturers in this country, Canada and Europe, and covers some 2,000 specific types of products they make. Here are the clues to the raw materials, production techniques and sources of supply to meet the new technical challenges of the 1960s in aerospace.

Performance of the difficult task of keeping track of the significant developments of a changing industry, and tabulating its size and scope in detail, has been substantially improved for this Bayern Guide issue by the use of modern data reduction techniques that will assure its already wide industry acceptance as a basic management tool. The acceptance of the Bayern Guide issue as a long-term management aid was documented by a study conducted on the previous edition six months after its publication. A total of 60% of the respondents in this survey still retained their copy and 55% said they referred to it at least once a month.

### Service to Readers

The Bayern Guide is an essential ingredient in the year-round editorial service that Associates With A Space Technology provides its engineering-management readership in the aerospace industry. In forwarding significant technical and economic trends, spotting their mutual convergences, who hard policy, and interpreting their long-range effects. In addition to the regular weekly issues, special editions are devoted to major forecasts about the entire technical spectrum in the "horizons of Aerospace Power" each spring; a special report is depth on the most important phase of research and development in each year, and the trends of international air transport in the fall.

In addition to its problems with changing technology, management in the aerospace industry will find next year a critical test of whether the aerospace type contract will really provide significant rewards for better cost performance and higher program management. As the procurement picture is now planned, industry profits should improve where performance matters. But, as with so many government policies, the distance between promise and delivery is often substantial. The scope and character of these potential variants should become apparent to industry next year in the application of the new type contract awards.

Next year will be the sixty-first year of the annual, the twentieth year of the liquid-fueled ballistic missile and the seventh year of the space age. The challenge to aerospace management to handle the combination of technical, financial, political problems and economic pressures that will be generated by these three facets of a common technology will never be greater.

—Robert W. Martin, Jr.  
Publisher



# DOD Maps Contract Management Changes

By William H. Gregory

Washington—Defense Dept.'s extensive modification of military procurement policies and procedures was completed for the most part this year, and next year will be one of consolidation and refinement.

Industry's day-to-day operations, however, may be strongly influenced by what will probably be DOD's only major new step in the 1964 procurement agenda. This is a field evaluation in the Philadelphia area of combining the contract management functions of the services, under study in DOD's Project 60.

Involving here are reporting requirements, regarded by contractors as a chronic headache. Industry feels reporting requirements are generally excessive, but for contractors with technology, government contracts with the military and with the National Aeronautics and Space Administration—they can be faced with as many as five different types of reporting formats, each with, necessarily, the same information but not asking for varying data.

Contract management, which covers diverse phases of primarily post award relations with contractors that include facility surveys, quality assurance, production expediting, plant expansion, plant transfers, etc., has grown over the last decade with little procedural problem as the beginning from DOD. Lacking such guidance, the services followed their own inclination to develop systems that DOD felt are not necessarily work, but do increase government and contractor overhead because of the differences.

Organizations and procedures for the pilot test are being recommended by the management consulting firm of Boston, Allen and Hammon in a subcommittee to the Logistics Management Institute, an advisory body to DOD.

The test, and Project 60, are under

the supervision of the office of the Assistant Secretary of Defense for Installations and Logistics, and the test program itself is under command of Brig. Gen. A. T. Stassen (top of the area, formerly commanding general of the Army's Electronic Material Agency in Philadelphia).

Included in the operation of the pilot model Contract Administration Service Region are 2,105 persons at 14 of 60 of the USAF Philadelphia Contract Management District, the Philadelphia Army Procurement District, the Inspector of Naval Material Office of Baltimore, Philadelphia, Pittsburgh and Reading, Pa., and the Defense Supply Agency Support Office at Philadelphia. Coordination between the test operation and DOD will be through the recently created Directorate of Contract Administration Services in the office of the Assistant Secretary of Defense for Installations and Logistics, which is headed by USAF Col. Donald E. Sewle. Responsibility of the Directorate is to formulate common procedures and policies in the contract management field.

The Project 60 task force, comprising 54 specialists in management and procurement from defense agencies and the National Aeronautics and Space Ad-

ministration, recommended establishment of the Directorate.

Plans for the test program call for it to begin in February, continue for three months, and lead to coverage under the Annual Services Procurement Regulations by July 1. The final system may be a combination of the best practices of the services or at least being about elimination of the less effective ones.

DOD and the services are proceeding cautiously in the program because of the possible impact on local government through permanent transfers and changes in installations. Almost 43,000 people in 661 field organizations are involved in contract administration and supporting services. Another reason is that Project 60 has stirred fears in the field that the entire procurement structure of the services will be reformed.

Top defense officials deny this, and say that as more consolidation of authority having a contemplated other than that in existence now with the Defense Supply Agency.

Increased emphasis on economic contracting and the reduction of cost-plus fixed fee contracts—will underwrite in the past months considered by defense officials to be the most significant phase of the current DOD procurement program.

But there are other important elements, too. Back to back policies, relatively late this year and which will not be fully felt by industry until 1964.

• **Program duration phase in a month.** previously, prior to concluding the development of new major weapons systems, USAF's Title 23 prior transfer system was the primary in this procedure two years ago.



PATTERN OF MILITARY prime contract awards to U.S. industry is sketched according to figures compiled by the Bureau of the Census, Department of Commerce. July and August of this year, the latest months of fiscal 1964, show increases over previous years.

• **Contract performance evaluation.** Initial reports are now in preparation under the procedure, but little application of its results is expected before June, 1964, at the earliest.

• **Weighted guidelines system.** Use of the system for setting target profits in all contracts that require cost analysis, i.e., advanced weapons systems development, becomes mandatory Jan. 1, but has been used as an optional basis in 1963.

Now these elements together are described by Gernse C. Baerensson,

deputy assistant secretary of defense for procurement.

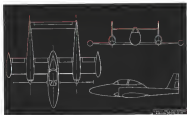
• **Program definition makes ordered application of incentive contracts possible.** Cost-plus fixed fee contracting stemmed from the assumption that specifications for complex, advanced weapons systems could not be defined adequately, contrary to firm pricing. By program definition, forces the government buyer to decide what he wants in enough explanation to find a meaningful and meaningful can be written. Without clearly defined goals, incentive

contracts cannot be written.

• **Incentive contracting and program definition make it easy to get into contract performance evaluation.** In having clear program goals and incentive values to indicate relative importance of goals as objective incentive can be written as to whether goals were met. All these elements make the weighted guidelines system possible. This system, incorporated into ASRA, provides the contracting officer with percentages weights to assign the cost-plus fixed fee incentive and incentive elements of a

## New Designs for COIN Aircraft

Defense Dept. emphasis on limited war capability has produced new concepts for counter-air warfare aircraft, like the one Squadron (left), and the Cobra Y-37 (right) modified under USAF contract. The YAT 37D carries two requests and can fold and swing each wing, has seven pairs of doors, the seat, and side track which for rough field operation. New proposals for this aircraft are General Electric H-12 (right) of 2,400 lb. weight each. The seat's concept illustrates concepts influenced by several magazines (NW Nov. 25, p. 25).





program to meet DOD's base of projects, to achieve half the profit earned on a goal to reduce costs of defense build rate.

The guidelines and the incentive got a good target and several other legs. "Benchmarking is not decreasing the availability from the government's standpoint as it is reducing the element of risk into defense contracting. But it is not all there to induce a real change in the pattern."

Beneath the pattern DOD seeks to change is the level of effort involved, the extent that parts of the man hours performed, regardless of the results achieved.

Emphasizing incentive contracting in the last two years was not accomplished without strong administrative pressure from DOD, and skepticism or resistance from the services or contractors.

Military procurement officials' interest not really the practicality, but the possibility of defining complex, sophisticated systems sufficiently to estimate costs adequately. And benchmarking was introduced. "Contractors used to get high profits without taking any risk."

Not enough contracts have been completed to indicate whether the prospective benefits of incentive contracts are being realized, reduced. But there are some in the air.

• **Shift away from plus fixed fee contracts** is proceeding faster than DOD projected. Cost plus fixed fee contracts had a high point of 50% of total contracts. DOD's goal was to reduce them to 13.5% of the total at the close of Fiscal 1985, and the total now is within a percentage point of that.

• **Variable fee contracts** appear to be falling, and support of the incentive

contract as a workable and useful tool is growing at the working level.

• **Use early incentive contracts** that let the Vela Hotel nuclear detection satellite (AWC Oct. 24, p. 38) hit getting into a good start to a better industry and government partnership.

A complex scale of performance targets and fees was worked for the program, which called for manufacturers to win awards of up to \$1 million for two based on successful launch and operation of the first pass, failing to put it in orbit, and maximum fee of all five was required.

Benchmarking said the first launch, which had no contractor participation, yielded on example of good incentive contracting, although cost was slightly over and the government might have been left with surplus space.

#### Increases in Net

Benchmarking referred to cost contrast to whose percentage of cost plus fixed fee backlog dropped from 55% to 45% in the last year. At the same time, its net profit rose 42% while its sales were increasing only 17%.

None of these indicators, it is an excessive evidence of permanent improvement of low aerospace industry profit margins. If incentive contracting program is advertised, there will be some examples of the opposite of high-low profits, or even a low profit on company profit and low cost. The effect is likely to be subtle since results of various programs in a company's overall business can usually be expected to vary.

Writing of good incentive contracts requires considerable skill for a body drawn document can prove to be a contract with increased profits for purchasing, something the government doesn't really want.

Lack of agreement in working and marketing agencies on a new contract could result in a substantial loss, paying for a margin that makes no sense, but failed to have enough stage or power.

#### Contract Pattern

In general, with incentive contracts which will come more and more into use will show performance incentives in research and development and cost and schedule incentives in production.

Incentive contracts can, but usually consist of a maximum target price, when which the contractor must pay or as all cost plus a fixed fee target, to a maximum only target, incentive and government share dollar fee target to cost plus types of the contractor may even all in a fixed price type

Heart of incentive contracting is in an acute situation of the military and aerospace costs likely, since this determines the range available for incentives to be used by the government or contractor.

Contract details are usually complicated. This 131 includes the contractor must meet in the time phase alone. Total award in the contract is to be paid in increments or penalties for meeting or missing key milestones in each time phase, and for other targets in cost and performance areas.

Program definition and incentive cost budgeting imperatively result in delays in meeting program milestones, which might be viewed as a drawback. Benchmarking feels this delay is offset by the time gained in development because objectives are clearly drawn.

"There is no question it induces change orders," he said. "The government doesn't get into the details of design as much as before because the contract is written around performance."

Less experience is available on use of the weighted guidelines (AW Sept. 2, p. 60), though much of its content has been government policy for years.

Benchmarking and the ASRP directive on weighted guidelines, whose first statement on profit attracted considerable industry comment, was in fact a re-statement of existing ASRP guidelines. As such, it had been honored more in the breach than in observance.

#### Profit Pressure

Some fear has arisen that the contracting effort may find itself in a difficult position if it negotiates a contract calling for significantly higher profits than have become customary. Benchmarking and the services of the system and its benefits were recognized in DOD and that support would be provided for the contracting effort. And he added, "They can expect to lead themselves in case of a hot spot if they don't follow the guidelines."

Of all the new procedures, the contractor performance evaluation has stirred the most dispute in industry, especially opinion of the design of future buying by clients at the end. The profits of lack of objectivity are reviewed in DOD. Besides requiring that reports outline themselves to factual statements of results in agreed contract goals with allowances for circumstances beyond control of contractor—review groups are given to the process charged specifically to ensure that such procedure is followed. Comments by contractors on evaluation also is required.

Past evaluations by contracting agencies under the system are now in progress and are due by Dec. 31. Sixty days

## Aerospace Industry Sales

VALUES OF BACKLOG REPORTED BY MANUFACTURERS OF COMMERCE AIRCRAFT, MISSILES AND SPACE VEHICLES REPORTED BY AIR FORCE, NAVY AND AIR MARINES, AND SELECTED UNITED STATES QUARTER 1983  
(Values in \$ million)

Type of product or service	Backlog at March 31, 1983	Second quarter 1983		Backlog at March 31, 1983
		Private contract	Govt contract	
<b>TOTAL</b>	10,314	2,074	820	14,334
United States Government	10,314	2,074	820	14,334
Other countries	2,434	144	134	2,712
Composites aircraft and parts, total	6,199	1,199	14	7,412
United States Government	6,199	1,199	14	7,412
Other countries	2,434	144	134	2,712
Aircraft engines and parts, total	1,491	394	7	1,892
United States Government	1,491	394	7	1,892
Other countries	2,434	144	134	2,712
Missile and space vehicle systems, engines, parts and accessories and parts, total	4,114	1,457	121	5,692
United States Government	4,114	1,457	121	5,692
Other countries	2,434	144	134	2,712
Space vehicle systems and parts (including spacecraft vehicles)	3,114	1,114	114	4,342
United States Government	3,114	1,114	114	4,342
Other countries	2,434	144	134	2,712
Engines and accessories (including engines and parts)	1,000	344	7	1,351
United States Government	1,000	344	7	1,351
Other countries	2,434	144	134	2,712
Missiles	1,000	344	7	1,351
United States Government	1,000	344	7	1,351
Other countries	2,434	144	134	2,712
Other aircraft, space vehicle and missile systems, total	1,244	394	121	1,759
United States Government	1,244	394	121	1,759
Other countries	2,434	144	134	2,712
All other products and services, total	1,491	394	7	1,892
United States Government	1,491	394	7	1,892
Other countries	2,434	144	134	2,712

Source: Defense Department, Office of the Under Secretary for Defense Acquisition and Logistics Management. Data are based on reports from contractors to the Department of Defense. Data are based on reports from contractors to the Department of Defense. Data are based on reports from contractors to the Department of Defense.

are allowed that date for failure and contractor receive full delivery to DOD.

Carl Hubert J. O'Connor, director of the program in DOD, said it was the goal to conduct the DOD and its special interest in procurement, and accounting, and to last review that for consistency and adherence to policy. Essential goal is a program can be the service, without much interference from DOD.

Point order agents will be limited to about 100 contractors, since contractors more than two years from date of award and with 50% or more of total funds spent were exempted.

It is expected for about two years. Existing equipment and facilities will be used for data change, but no new data has been chosen yet for the data bank. One possible site will be the Defense Data Research Center, the former Army Services Technical Information Agency, that is now part of the Defense Supply Agency Headquarters at Cameron Station, Alexandria, Va.

Initially, data entered will provide the entire record of a contract, since it currently will be small. Eventually, the data bank will provide complete specific weight in contract record books on any specific contract, or some of contracts.

Reports will be provided in their original format form, with no coding or symbol system, or any type of grading.

## Aerospace Industry Backlog

VALUES OF BACKLOG REPORTED BY MANUFACTURERS OF COMMERCE AIRCRAFT, SPACE VEHICLES, MISSILES AND SELECTED UNITED STATES QUARTER TWO-THIRD AND SECOND QUARTER 1983  
(Values in \$ million)

Type of product or service	Second quarter 1983		
	Backlog at March 31, 1983	Backlog at April 30, 1983	Backlog at May 31, 1983
<b>TOTAL</b>	10,314	12,334	14,334
United States Government	10,314	12,334	14,334
Other countries	2,434	1,444	2,712
Composites aircraft and parts, total	6,199	8,199	9,412
United States Government	6,199	8,199	9,412
Other countries	2,434	1,444	2,712
Aircraft engines and parts, total	1,491	1,491	1,892
United States Government	1,491	1,491	1,892
Other countries	2,434	1,444	2,712
Missile and space vehicle systems, engines, parts and accessories and parts, total	4,114	4,274	5,692
United States Government	4,114	4,274	5,692
Other countries	2,434	1,444	2,712
Space vehicle systems and parts (including spacecraft vehicles)	3,114	3,114	4,342
United States Government	3,114	3,114	4,342
Other countries	2,434	1,444	2,712
Engines and accessories (including engines and parts)	1,000	1,000	1,351
United States Government	1,000	1,000	1,351
Other countries	2,434	1,444	2,712
Missiles	1,000	1,000	1,351
United States Government	1,000	1,000	1,351
Other countries	2,434	1,444	2,712
Other aircraft, space vehicle and missile systems, total	1,244	1,244	1,759
United States Government	1,244	1,244	1,759
Other countries	2,434	1,444	2,712
All other products and services, total	1,491	1,491	1,892
United States Government	1,491	1,491	1,892
Other countries	2,434	1,444	2,712



# DSA Aerospace Procurement May Grow

**Camden Station, Va.**—Aerospace in daily contracts may find the Defense Supply Agency becoming a larger factor in its business next year as a result of a study of combined management of aircraft turbine and piston engine spare parts, and aircraft dies.

Following a pilot study of the overall \$10.12 billion, 716,000 items military ammunition spare inventory in 1961, a more detailed evaluation began early in 1962 of 33 federal supply centers covering 178,000 items with a \$740 million value, all but the two categories relating to aircraft engines.

The study, by an Aero-Navy USAF team headed by USAF Col. Robert E. Thorne, of the Defense Supply Agency, is now in the report preparation stage, following visits to USAF Air Material Area centers, Air Force Logistics Command, the Aero's Aviation Center at Ft. Belvoir, Mo., and the Navy's Aviation Supply Office in Philadelphia.

The report is due to go to Defense Secretary Robert McNamara at the end of the year. It may also be referred to the services and the Defense Supply Agency Council, making a decision unlikely before spring.

No other such a new order study for consolidated management, but aircraft contractors are doing an increasing amount of business through the Defense Supply Agency's Defense Electronics Supply Center at Dayton, Ohio. This center, which April 1961 took over the old class of an \$80,000 items military electronic inventory.

Procurement this year by the Electronics Center—covering such products as electronic components, tubes, tubes, connectors, cables, antennas, waveguides, aluminum hardware and hardware—will rise about 20% to an estimated \$437 million.

In fiscal 1963, procurement at the Electronics Center was 55% pure non-petitive, much of it formerly abstracted, and that figure rose to 53.9% for the first four months of Fiscal 1964. The Electronics Center is a broad-based unit at the center, though individual items are often consolidated into packages that can be supplied by companies with multiple product lines.

The Defense Electronics Center buys and manages one of the three basic categories of military hardware:

- **Code A items** are those of unclassified design or of otherwise critical requirements for a particular weapons system. These the services buy from civilians.

- **Code B items** are repetitively produced stock items, what would amount to catalogue items. These fall into the

## Defense Supply Agency inventory

• **Code C items** are customer items, available as stock on contract, and usually bought locally.

The Defense Electronics Center absorbed the Dayton Air Force Depot, which had managed USAF inventory procurement for 25 initial active items, and a new absorbing Navy and Army electronic inventories.

Expansion at the Electronics Center in responding to service requirements has been anticipated, according to Defense Supply Agency officials. For example, the center, which is tied in to the Air Force, automatic data processing program, has been able to assist Strategic Air Command's electronic operations in electronic equipment.

Air Force and Army have requisitioned directly to the Electronics Center, and there are supplied from Dayton at from a depot at Dayton, Ohio. Other District storage procurement, however.

New signs and have generally equated on Navy Supply Center at Norfolk, Va., or Oakland, Calif., and there marks. In 18,000 stock items and Defense Supply Agency \$550.

• **Fuel requirements** for military commands are handled by the Defense Petroleum Supply Center.

Defense Supply procurement is largely self-sufficient in the Center's business. Daily published by the Department of Commerce. Construction can be placed on lot for substitution of fully by writing Defense Supply Center and filling out required forms. For construction, purchased items are made prior to contract award, but are not required for full situation.

Following the delivery for goods and services, the Defense Supply Agency provides additional information of possible interest to aerospace companies.

**Background:** Defense Supply Agency is located at:

**Headquarters:** Defense Supply Agency, 4000 North 1st St., Dayton, Ohio 45424.

**Regional:** Defense Supply Agency, 4000 North 1st St., Dayton, Ohio 45424.

**Production Products:** Defense Supply Agency, 4000 North 1st St., Dayton, Ohio 45424.

**General:** Defense Supply Agency, 4000 North 1st St., Dayton, Ohio 45424.

**Technical:** Defense Supply Agency, 4000 North 1st St., Dayton, Ohio 45424.

**Construction:** Defense Supply Agency, 4000 North 1st St., Dayton, Ohio 45424.

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Three other areas of Defense Supply Agency operations are of possible interest to the aerospace industry.

- **Technical products:** equipment managed by the Defense Industrial Plant Equipment Center at Memphis, Tenn., which was activated this year. Though it has no procurement of inventory, the center serves all contractor tooling plans to ensure that existing or new government inventory at an storage area that can be requisitioned is used before new tooling is purchased. The center also handles disposal of surplus government machine tools.

- **Industrial and construction supplies:** Not generally considered as aerospace equipment, these do play a role in weapons systems. Of the 95,000 stock items for the Defense Plant Building, the Defense Supply Agency manages 17,000 of the items, including such items, Defense Supply Agency handles 4,000 items for the use portion of the USAF and supplies other contractors.

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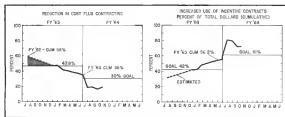
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**REDUCTION IN COST** plus fixed fee contracting and increase alternative types of contracts for the Air Force Systems Command was emphasized in Fiscal 1961 and the first months of Fiscal 1964. Contracting on cost plus contracts (left) and increase 51% incentive target (right) also are indicated. The two relationships are not completely similar because of use of other types of contracts such as fixed price. Graph for Fiscal 1963 was not available for analysis, but they have been included in both categories industry in Fiscal 1964.

## USAF Adapts Contracting to New Climate

**Washington**—Air Force is handling into a second generation of holistic management development and contracting.

One described by Maj. Gen. Lee W. Latham, director of procurement and production and Logistics Command, is under way at the Air Force Systems Command.

Under the Air Force Systems Command, the Air Force Systems Command is finding that fixed price contracting can be used in some development areas.

Major emphasis is being placed on young rather than on the Air Force Systems Command, which is the Air Force Systems Command.

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testing out of such contracting techniques in the support field of aerospace services.

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Cost-plus contracts are not to be abandoned, however. Study contracts that produce no incentive are one category that does gain such a contract, but Systems Command is raising an alternative for cost-plus use and the standard of profit usually falls on the contractor.

Two other procurement problems are the subject of campaigns in Systems Command.

• **Reduction of letter contracts.**

• **Emphasis on incentive awards to encourage competition.**

Letter contracts have been of special concern to Systems Command because a letter contract is worth \$2.4 billion total in Fiscal 1962 compared with only \$1.1 billion with other contracts.

The total has risen from last to about \$700 million but further reduction are sought.

Various reasons exist for the problem, including, for example, the previous USAF development and procurement structure. But the problem is not a simple one.

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# NASA Plans More Competition, Incentives

By Alfred P. Albano

Buying and contracting practices of the National Aeronautics and Space Administration are changing markedly, with increased emphasis on competitive awards and wider use of incentives the major outward signs of the change.

"We feel we've had very good results from our first incentive contracts, which we negotiated this year," said George J. Vecchietti, Jr., deputy director of procurement. "We plan to use more incentive contracting on a selective basis. Incentive because incentives are difficult to apply in research and development."

NASA's procurement regulations require that procurement plans for contracts valued at over \$5 million consider incentives. All non-competitive contracts for over \$5 million must be approved by the agency's top management.

In the last half of 1962, 51% of NASA's procurement was on a competitive basis. During the first half of 1963, this ratio increased to about 57%. But NASA is still not satisfied and now seeks to increase competitive contracting by separating that non-competitive awards be made without approval of senior officials in NASA headquarters top management.



**First Production S-4B Tank**

CYLINDRICAL SECTION OF LIQUID HYDROGEN tank of the first Douglas S-4B Saturn stage rests in a jig in it is prepared for welding of an angle steel on one end to which a skirt will be added. This tank will be tested to determine if a "bolting tower" built recently and fitting of the S-4B, up to the stationing being steps will be done at the new Douglas Space Systems Center at Huntington Beach, Calif. New manufacturing recently building has 120,000 sq ft. Workers gather today from time to time to which the angle is attached. Welders stand at the top of the welding tower at left.

has been effective by Congress, the Budget Bureau and the comptroller general of NASA's service contracts. The Bellows and General Electric Apollo service contracts, made under special authority in Congress last year.

Despite the criticism, NASA maintains that it is more practical and cheaper in the long run to meet peak demands by contracting for outside services. Rather than abandon the hiring of outside services, NASA will try to write contracts for these services in such a way that they meet with the approval of the comptroller general.

NASA also plans to improve its cost estimating procedures because in almost every major program, the agency has underestimated costs by as much as 100% or more.

"We now have five years of experience to draw on," said Vecchietti. "NASA also will make a study of the methods and by industrial firms which historically have been the most accurate in estimating research and development costs."

## Cost Reduction Programs

Cost reduction programs also are under study, and NASA is looking at both its own laboratory operations and those of its contractors in areas where costs might be cut. From these early studies will come recommendations on specific industries and NASA laboratories where cost reduction programs look most promising.

Ball member told NASA will use to improve its procurement machinery in the Defense Dept. contractor performance evaluation. NASA has decided an incentive method it will use, but it is likely that the agency will rely on its financial management team already available in the Defense Dept. data bank in performing the evaluation.

NASA's lighter procurement practices stem from both the agency's in-house studies and the new rules set last Oct. 1—and the first set of objectives expressed last year in Congress to the Apollo manned lunar landing program. Although NASA Administrator James E. Webb reportedly said the \$5.73 billion reported for Fiscal 1964 was equivalent to "incentive" budget, Congress cut this to \$5.55 billion in the authorization process and actually appropriated only \$5.1 billion.

NASA was forced to slow down the Apollo program because of the cut in Fiscal 1964 funding, and there is a general fear within the agency that inadequate appropriations over the next

# In Contracts

two years when the buildup in the manned lunar landing program should be at a peak will further cripple the program.

President Johnson will ask about \$5.1 billion for NASA in Fiscal 1967. But if Congress funds the Fiscal 1967 request the one it did the 1964 NASA budget, the agency will come out with no more than \$5 billion.

## Policy Changes

Policy shifts in procurement are directed at dispelling charges of waste and duplication in the space program and in spending the week congressional is well in to come from. Through the bulk of NASA prime contracts is still won by aerospace firms on the East and West Coasts. Webb said earlier this month that in 1963 NASA will have spent 93% of its funds, or more than \$4 billion, through prime contracts with 2,500 firms in 46 states and the District of Columbia.

The Fiscal 1961 procurement report was in preparation will show little change from Fiscal 1962 to the 10 states receiving the largest dollar volume in NASA prime contracts. California, the leader, received more than \$1 billion. Next in order are Missouri, Louisiana, New York, Alabama, Florida, New Jersey, Texas and Minnesota.

In Fiscal 1963, 15 of the 100 largest contracts let by the agency were received by small business. And small business received over \$90 million in contracts over \$25,000.

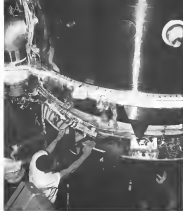
There is a small business adviser at each of NASA headquarters and at each center who screen proposed purchases or contracts over \$1,000 to determine whether and how small firms can participate in the procurement. Small business desire to acquire NASA work with their capabilities on non-ferrous subcontracting opportunities should contact the small business adviser at headquarters.

Following is a summary of activities conducted at the agency's headquarters and research centers.

## Headquarters

This division is responsible for headquarters procurements and contracts covering reliability studies, management analysis, the initial phases of research and development projects, feasibility studies, lunar landings program and other equipment and supplies needed for support of headquarters activities.

Research grants and contracts with



**Centaur Stage Mated to Booster**

GENERAL DYNAMICS/AERONAUTICS CENTAUR high-energy upper stage is mated to an Atlas booster on Feb. 16 at the 27 launch from the John F. Kennedy Space Center at Cape Canaveral (AFW Dec. 9 p. 30). Flight was first success after program management was shifted to NASA's Lewis Research Center. It also marked the first flight demonstration of load-bearing on a launch vehicle. Centaur's two Pratt & Whitney RB-253 engines each rated at 51,000 lb., are shown below as the stage was lifted into place. Ground test program which led to successful flight continues through numerous on-orbit and development Centaur vehicles. First flight test vehicle is tentatively scheduled in 8, only next year.





nonprofit and scientific and educational institutions as the responsibility of the Office of Grants and Research Contracts at Headquarters.

#### Ames Center

Ames has project responsibility for the Pioneer spacecraft and the first satellite Pioneer as an unmanned probe designed to study the space environment and Rosetta will investigate the effect of ion environment on earth organisms, including monkeys. NASA's life science laboratory also is located at Ames.

Research activities at the center include orbital and planet-tailor atmospheric research, basic studies in planetary entry and environmental physics, and also in orbital systems: celestial, physiological and behavioral sciences, and human factors.

#### Flight Center

Mission of this center is research connected with flight in the stratosphere and space from low speeds to hypersonic velocities. Programs in which the center is participating include the X-15, supersonic transport and payload development. Ground-based and on-flight research includes work on loads and structures, aerodynamics, thermodynamics and toxicology.

#### Goddard Center

Goddard Space Flight Center has the broadest responsibility of any

NASA installation. Its projects include most of the scientific satellite and space responsibility for communications and weather satellite programs. Goddard also directs the operations of NASA's world-wide unmanned flight, orbital and satellite tracking, communications and computing system networks and various launch teams at both the Pacific and Atlantic Marine Ranges.

#### JPL

Governments-owned, Jet Propulsion Laboratory is operated by NASA, by the California Institute of Technology. Most of the laboratory's work is connected to the Ranger and Surveyor unmanned lunar flight programs. The Mariner planetary mission is managed by JPL.

JPL also manages the deep space tracking network.

#### Langley Center

Langley Research Center conducts scientific and technical investigations on a broad scale in the areas of vehicle configurations, materials and structures, reentry, applications of new materials, supersonic and hypersonic flight, navigation and lunar landing techniques, inflatable and extricable manned space vehicles and design and improvement of inflatable passive communication satellites. Langley Research Center also manages the lunar orbiter satellite program.

#### Kennedy Space Center

Recently renamed for the late President, the center has facilities at the Atlantic Marine Range and Merritt Island that include buildings and equipment—mostly under construction—for integration, test and checkout of the Apollo spacecraft. NASA operates or directs facilities on the Air Force portion of the Atlantic Marine Range for preparation, test and launch of the Gemini manned spacecraft and its unmanned satellites and probe projects.

#### Lewis Center

Primary mission of Lewis Research Center is research and development of advanced propulsion and space power applications. This includes high-energy chemical, nuclear and electric nuclear engines and space power systems for converting chemical nuclear and solar energy into electricity. Lewis also has project responsibility for the development of the M-1 liquid hydrogen engine, Centaur launch vehicle and Apollo stage propulsion.

#### Manned Spacecraft

Planning and carrying out manned space flight programs, from the start of the manned vehicle, is the primary mission of the Manned Spacecraft Center. This mission includes the planned Mariner program which was completed with the Mariner 9 spacecraft. This center also studies future projects, such as manned space vehicles and planetary missions.

Spacecraft design, crew training, space machine, and crew equipment also are responsibilities of this center.

#### Marshall Center

Development of large boosters is the primary responsibility of the Marshall Space Flight Center. Current programs include development of the Saturn I, Saturn IB and Saturn V launch vehicles. Marshall also is developing requirements for larger, non-cyclic vehicles for future planetary missions. These studies include combinations of large liquid and solid stages, nuclear and other high specific impulse upper stages.

#### Nuclear Office

Space Nuclear Propulsion Office is a joint NASA-Aircraft Energy Commission facility, concerned primarily with the development of nuclear rocket engines for advanced launch vehicles. To accomplish the objective, the office is directing a program of research on reactors, engine systems, development of

## NASA PROCUREMENT OFFICES

National Aeronautics and Space Administration, Washington 25, D. C.

Conrad M. Brockitt, DG 3-8544

Joseph M. Ray, 383-8337

Director, Procurement and Supply

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#### GODDARD SPACE FLIGHT CENTER

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Sub Office: Space Nuclear Propulsion

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\* George Kimball, 253-7700

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Mountain View, California

383-8337

#### Wallops Station

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\* Louis J. Birch

\* Harry Hamblett

#### NORTHERN OPERATIONS OFFICE

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Telephone: 85-2-9641

\* Eric J. Sample

\* Alexander Muzzey

\* Permanent Officer

\* Staff: Release Specialist

blast exchange type rockets, engines and stages, and separation of multi-segment stages and vehicles for flight test, all parts of the River project.

#### Wallops Station

Wallops Station has been conducting rocket flights since 1945 in aeronautical and space research programs. Most launches from Wallops are sounding balloon flights using vehicles with a range in size.

Liquid vehicle launched from Wallops is the Scout solid fuel launch vehicle, which is used for both high altitude, re-entry tests and sounding balloon satellite flights. A second Scout launch and is being completed.

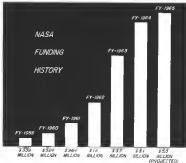
#### Northeastern Office

Mission of the Northeastern Office is to provide liaison with industry and scientific and educational institutions in the northeastern states. The office, located in Cambridge, Mass., also coordinates advancement and public NASA contracts and grants within the region and conducts special projects and services.

#### Western Office

Western Operations Office, in Santa Monica, Calif., maintains NASA contracts, performs technical monitoring and administers headquarters on technical development and regulations.

BRIEFING ON A GEMINI SPACECRAFT was given to Astronauts at the IBM Space Goddard Center, Orange, N. Y., by IBM engineer Edie Buchanan, left. She discussed the system with Astronaut Virgil I. Grissom, General Manager Arthur F. Cooper, Astronaut Neil A. Armstrong and James C. Howley, IBM's Gemini technical coordinator.





## Small Business Defense Role Stressed

By Katherine Freeman

Washington—Small business—generally a firm with 500 or less employees—is now receiving about 59.2 billion annually in prime and subcontract from Defense Dept. and National Aeronautics and Space Administration.

There has been a slight, but steady decline in the dollars share of prime awards to small firms, a few percentage points over the past few years, attributable to the almost insurmountable growth of the increasing complexity of weapons and space systems. To offset this downward trend, the government effort is directed toward programs and policies that will increase small business participation in subcontract work.

An expensive government defense task watches over the interests of the small business segment of the economy—something few Congress to small government offices in these methods.

• **House and Senate** both have special committees on small business. The Senate committee is headed by Sen. John Sparkman (D-Miss.), and the House committee by Rep. Joe E. East (D-Tenn.). These committees have also served as a source of last resort for small firms that feel they have accrued unacceptable treatment in government procurement as policy.

• **Small Business Administration**, which guides the small business program of all other government agencies, is still popular. It takes care of about 1,500 reviews and an annual budget of over \$16 million. This agency gives financial, management and production assistance to small firms, as well as assistance in obtaining government business. It has field offices in 48 cities.

• **Defense Dept.** has small business offices at the top policy level now in the office of the secretary of defense, and the Departments of Army, Navy and Air Force. To address the department has about 500 small business specialists throughout the country.

• **NASA**, similarly, has a small business policy division in headquarters here, and small business specialists at each of its major centers.

Defense Dept. is now working about \$4.6 billion a year in prime awards to small businesses. Small firms obtain about \$200 million more in prime awards from Defense Dept. for man-made and space systems. This amounts only 1.6% of the department's total annual awards of about \$6.7 billion for these systems.

The area in which small business appears least equipped to compete is development. Small firms receive only 0.4% of Air Force's development work, 0.4% of Army's, and 0.4% of Navy's. Small business participation is in general substantially greater than in

development. Small firms obtain about 0.5% of Air Force's defense R&D research, 0.4% of Army's, and 0.5% of Navy's.

Defense subcontract awards to small business are running about \$4.3 billion a year. The department has divided the 406 largest defense contractors into four groups: Army, Navy, Air Force and Defense Supply Agencies each have responsibility for monitoring the small business subcontracting program for one of these groups.

Defense now aims at stimulation that will increase subcontracting activity in revenue showing the extent to which small firms can give an opportunity to compete for subcontracts.

Defense Dept. admits that its small business program is conflicting with two other Defense government goals:

• **Cost reduction**, under which cost-plus fixed fee contracts are being canceled sharply and emphasis placed on fixed-price type contracts. Contracts which are awarded at a price and open competition with the price fixed by the bidding procedure encourage bidders to seek the most qualified subcontractor and maintain lowest prices to meet favorable without discrimination between large and small.

• **Defense Dept.** says, "The cost-plus fixed fee contract is placed out, and as the fixed-price with incentive type contracts are used in increased, the percentage of the government's control over the execution of subcontract is brought into sharp focus."

• **Labor surplus area**. This program serves as a source of prime and subcontract work for bidding by firms in areas of heavy unemployment. No during time is made as to whether bidders in the unemployment areas are small or big business. The program is in competition with this policy to act on defense work exclusively for bidding by small business.

NASA prime awards to small business are now running about \$140-\$150 million a year—in about 10% of NASA's total direct awards.

Small business has had a rather low record of responding to NASA's solicitation to bid. In one period, NASA solicited bids from small businesses in 20% of the dollar value of its total procurement. Small business obtained bids on only 52% of the dollar value of these solicitations.

Subcontracting in small business (NASA) has established a subcontracting reporting system to determine the extent to which its prime contractors are encouraging small business participation in subcontract work.

NASA and Defense contract points for small business are listed below.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
SMALL BUSINESS  
POLICY HEADQUARTERS  
WASHINGTON, D. C.

Office of Procurement  
Mr. William A. Smith, Jr., Director  
Mr. John W. Smith, Jr., Deputy Director  
Mr. John W. Smith, Jr., Deputy Director  
Mr. John W. Smith, Jr., Deputy Director  
Mr. John W. Smith, Jr., Deputy Director

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
SMALL BUSINESS  
FIELD REPRESENTATIVES

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## Growing Need for Avionics Speeds Uses

By Kenneth J. Stein

Changing patterns of technology may exert their influence on the direction of business developments in the coming year, reversing the swing that last year placed emphasis on leader coordinations.

As the aerospace industry has become increasingly systems oriented, it has required the services of advanced, high speed data processors, more sophisticated and precise navigational gear, sophisticated communications and transponder capabilities, multichannel telemetry, and specialized input and output hardware.

Domestic producers have studied imports and value-added to meet the requirements of a continuing process of innovation that has led to a more robust, comprehensive, flexible, to levels of capability, and infinitely compatible with the overall demands of the system.

In effect the changing technology tends to shift the identity of the peripheral academic job.

A need to upgrade the quality of design components was intensified by the advent of satellites, telemetry and the inherent reliability of the transistor. Never before, such a tremendous

effects and other environmental conditions in space. In the case of the Rhea 1 satellite, for example, the weak link proved to be a wholly unexpected effect of extremely low temperatures on our critical transmitter (AVM Dec. 2, p. 57).

loadings, temperature and pressure, may have been equally critical in affecting structure. Growing knowledge of the ranges of the space parameters and of all the components and sub-systems that may be exposed to it must be expected to lead to a more realistic appraisal of the parameters that must be measured to give meaningful projections of life structures.

With increasing use of semiconductor microcircuits, internal connections are becoming a new area of critical low-level interconnection. It has already been a source of many problems in circuits that diminished in size, and one solution has been a major interconnect based as in the Advanced Microdevice

Solutions to these and similar problems will be forthcoming with increased application of semiconductor

microcircuits, and current figures indicate that this increase is rapidly developing.

Sales of semiconductors continuously increased in the third quarter of 1963 to 142 million—a factor of almost three, compared with 51.4 million average quarterly sales for all of 1962. Ship orders are expected to jump further next year.

Emphasis on constrained and controlled systems contracts to expand, underscored by the recent dedication by USAF's Electronic Systems Div. of a new Systems Development Laboratory at Lowry AFB, Colorado. The facility, located at Lowry AFB, Colorado, is a new \$10-million facility, dedicated to the development of electronic systems for the Air Force.

The laboratory, to be operated by Electronic Systems Div. and the non-profit Mitre Corp., will be to command and control systems what a wind tunnel is to aerodynamics, one official said. The facility will make use of its IBM 7090 (Stretch) computer and of means which can be configured in command posts for various systems under test to evaluate future command and control systems concepts.

Current experiments will deal with improving communication between commanders and their data systems with the intent of streamlining two concerning programming of computer and translation of information into machine language. Future USAF L-39s

ated systems are expected to benefit by the simulation techniques, which are certain to affect future procurement.

An application for the optical method (used as a means of detecting clear-air turbulence through a laser radar technique which might detect shears, or discontinuities, not detectable by RP radar) has been proposed. Scientists at Minto-Ontario speculate that the shear might provide sufficient reflections to laser radar.

In another application of the laser, NASA plans to test the device as a spacecraft-to-ground communications link.

Changing patterns are anticipated in product market size—mostly up, from equipment—according to guide lines established by Special Committee 101 of the Radio Technical Commission for Aeronautics.

Prepared in the form of a process list for systems engineering for various classes of aircraft the RTCA report considers the tools of air traffic control and navigation as related to Federal Aviation Agency plans for the future. On this basis, it establishes an order of priority for various equipment.

Equipment elements acquired, depending on services required from the ATC system, will include:

- VHF transmission system
- VOR navigators, implemented by

\*ATC transponder, supplemented by automatic altitude report.



## Manufacturers Review Component Buying

By Kevin J. Bolton

Dallas, Tex.—Business flying is continuing its record upward pace as a fast growing segment of the U.S. aerospace manufacturing and sales industry.

This year's production will probably run 600,700 more units than the 6,700 turned out in 1962, with a dollar volume approximately \$15 million to \$20 million higher than last year's \$180 million retail value, the Aerospace Industries Assn. estimates. Industry leaders see no let down in sight for next year.

Already the largest one of U.S. sales in number—50,000 airplanes versus approximately 1,000 scheduled airlines and 31,700 military aircraft—the general aviation fleet will steadily increase the disparity in just a few years, the Federal Aviation Agency estimates. In five years, 98,000 general aviation airplanes will be sharing the airspace with the country's approximately 35,000 military and military types, the agency forecasts. General aviation aircraft industry has never before FAA figures are on the conservative side.

Business preference continues towards faster, heavier, better-equipped, more comfortable and twin-engine aircraft. In five years, multi-engine business airplanes will outnumber scheduled airlines by nearly 12 to 1, FAA forecasts.

Growing sophistication in business aircraft and their equipment will be another trend in the coming year with deliveries starting of the new class of light jets, characterized by the new Jet Commander and the Lear Jet. This development, though several years behind the scheduled airline jet equipment transition, holds promise of overtaking a comparable aspect in business flying, although its period probably will not be clear until 1965. Some observers find it plausible that the business aircraft jet fleet could number 1,500 units in the next decade.

The rate of sales growth forecast by government and industry personnel in staff reports reveals the sizable market developing for suppliers and vendors to business flying aircraft, powerplants and equipment components and also in the service and maintenance fields. But their viewpoint points to problems areas that must be solved.

Competition in new product lines will definitely increase as additional suppliers lead to seek their share of the available business. From the aerospace manufacturer's standpoint, he will be increasingly critical of quality and reliability and is looking more and more at his product as an avionics, rather than an airplane carrying a collection of equipment.

Industryists are that the airplane builders are becoming less tolerant to

would suppliers whose products show low scores in quality of workmanship or reliability and thereby are developing a reputation supplier lists from which suppliers will be selected and rated continuously. In some cases, there is thought being given to a direct manufacturers to avoid developing new equipment suppliers. Some are putting these out bids and evaluations, similar to the system used by the military services.

Boeing Aircraft Corp., one of the major business aircraft builders, spent \$12 million in its 1963 fiscal year with suppliers and vendors not counting out amounts such as sheet metal stock and does a spare parts and accessories business of better than \$7 million annually. Expectations are that this latter phase of its operations is headed for a huge increase in future years. Other airplane builders are showing similar rapid growth and expansion sales.

This part of the business field is an indication of where problems are developing. The airplane builders are tending to enlarge their volume of items purchased from vendors, but with growing additional needs to be met on it and its own distributor-dealer network handling overhauling. The original parts manufacturer is attempting to

market similar items under his own trade name, often at the expense of the same suppliers. There there are major distributors of those parts lines and equipment manufacturers who are trying to keep out of the share of this market and are also increasing competition.

Exact data on how much business these distributors are currently doing is difficult to assess, since they do not readily furnish sales figures. But 13 members of one distributor association are doing approximately 57 million monthly supplying the needs of airlines and fixed base operations, with probably less than half that dollar volume in air line sales.

A typical large parts and accessories distributor, Southwest Aerospace Corp., expects to do about \$4 million in business in its 1964 fiscal year, half of this in the general aviation market. The Austin, Texas-based distributor covers 15 states, operating three district offices in addition to its home base at Love Field, Dallas. Southwest Aerospace estimates it has about 1,000 customers in its territory and does a gross volume from \$200 per month on as much as \$50,000 monthly for bigger accounts.

This distributor has been gearing for the buildup in the general aviation market in recent years. At one time, approximately 50,000% of its volume was with scheduled airlines.

A primary concern for both airplane and equipment manufacturers is development of additional sales outlets to be able to reach more prospects and provide the airplanes that are being with greater ability by making new landing and service facilities available.

It is a drastic argument that each line has not kept pace with the growth of the industry. Hangar space is at a premium. A recent Boeing survey showed that the bulk of this country's general aviation fleet—about half the single engine and three-fourths of the single engine aircraft—are located in 400 over crowded, all of which have populations of 75,000 or less. But at airports at these locations there were approximately 20 airplanes per acre maintenance or storage hangars.

Also, a detailed Census survey, completed this year, pointed out that there were only 3,554 certified fixed base operators against a total of over 7,000 airports, indicating a dearth of operators. Considering that attended airports over 2.5 operations, this means that several thousand airports lack adequate sales, service and maintenance facilities.

AERO COMMANDER's Jet Commander (above) is shown with added 30 in. fuselage section forward of the entrance door, lengthening fuselage to 70 ft. 11 in. Gross weight of the aircraft has been increased to 30,000 lb., allowing an increase in fuel load to 8,700 lb. Jet Commander is powered by General Electric CJ610 turbojets. Upper wing section is equipped with speed brakes.



NORTH AMERICAN SARABELINE (above) is shown during forward turn with gear, flaps and speed brakes extended. Aircraft is powered by two Pratt & Whitney JT11A engines. Executive Model 22 (below) has engine nacelles redesigned for the General Electric CT700 turbofan. Note two American World Airways airbrakes on tail. For Air Canada 40 Model 22 (SW Air 12, p. 42), with options for 122 seats. Discounts and U.S. will have U.S. built components and leading gear components.



#### General Aviation Aircraft By Category Estimated 1960-1970 Fleets

Year	Multi-Engine	Single-Engine		
		Prop	Eng	Total
1960	9,506	54,478	54,478	71,728
1961	7,700	51,500	51,500	56,600
1962	8,300	57,500	54,100	79,900
1963	9,700	59,500	54,000	85,200
1964	9,900	65,000	55,000	89,900
1965	10,000	64,000	55,000	93,000
1966	10,500	64,000	55,000	95,000
1967	11,000	64,000	55,000	96,000
1968	12,000	64,000	55,000	96,000
1969	13,000	64,000	55,000	102,000
1970	14,000	64,000	55,000	105,000

Source—Federal Aviation Agency









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A controlled compression crimping technique for terminating the widest range of wire sizes of every type—solid, stranded and irregularly shaped—singly or in any combination. Reliability assured through matching tool to terminal so that every connection of a given size and type is perfectly identical in appearance and performance by the tens or the tens of thousands. Color coding of terminal and matching tool to prevent operator errors at an absolute minimum and further add to the quality control measures utilized in creating the basic product. An and retail of unqualified superior performance, maximum reliability and conformance to the most stringent commercial and military requirements.

#### THE COMPANY

A worldwide network of manufacturing and distributing facilities with complete duplication of products and services stringently located to fulfill customer needs promptly and efficiently. A worldwide sales force backed by Field Service Engineers, Creative Analysis Teams, Employee Instruction Personnel, New Product Seminars, the AMP Method, modern Research and Testing facilities and a Speed Order Service for fastest possible delivery of the product.

AMP — PIONEER AND WORLD LEADER IN THE DEVELOPMENT AND MANUFACTURE OF SOLDERLESS TERMINAL AND CONNECTOR PRODUCTS FOR SPACE AGE ELECTRICAL/ELECTRONICS CIRCUITRY



For a brief description of the products listed below, see the following pages:

- Coaxial cable and shielded wire products
- Pin and socket multiple connectors
- Programming devices
- Printed circuit connectors
- Taper technique
- Hermetic/plastic connectors
- Application tooling

FOR FURTHER INFORMATION ON ANY OF THE PRODUCTS LISTED ABOVE, THE COMPANY, ADDRESS, CIRCLE NUMBER INDICATED HEREON, SEE PAGES 10-11



## COAXIAL CABLE AND SHIELDED WIRE PRODUCTS

### COAXCON® CONNECTORS

A complete line of multiple and single-wire connectors for coaxial cable covering 360° cable sizes (0.034" to .250"). Terminations are made with AMP's exclusive die-cast stamping action—no solder or the melting AMP's stamping tool makes wires conductive, solder bond and cable support—completely! Perfect plating—AMP shielded gold over nickel—assures maximum conductivity and long time reliability.

### TERMASHIELD® SPLICES AND FERRULES



Selection includes pre-and-post insulated types for both single and multiple conductors. Choice of nylon and Teflon® insulation. Included are special heat-shrinkable ferrules and splicing design and pre-insulated ferrules for pre-and-post insulated boards. Crimping process assures connectors of maximum conductivity, long resistance to vibration and corrosion. The key is a ferrule strength supporting that of the wire itself.



AMP-CONNECT® Type IV Connector  
12 and 20 positions



STAMP-IT® Connector  
14 and 20 positions



RMC-insulated coaxial connector for radio equipment  
RMC-1000 or RMC-2000



Shielded Mil Connector  
and Shielded Wire



Thermal Mill Connector—shielded wire and structure store special features adaptation for shielded cable shield

AMP-CONNECT Printed Circuit Connectors are available in one and two piece types featuring stamp stamped contacts. Can connectors are not pre-insulated—any these shields. Assembly is fast, circuit requirements need be used! Special contact



PRINT-ABLE CONNECTOR  
14 and 20 positions  
10 positions  
Shielded wire connector



AMP-CONNECT CONNECTOR  
14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 100, 102, 104, 106, 108, 110, 112, 114, 116, 118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138, 140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186, 188, 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 210, 212, 214, 216, 218, 220, 222, 224, 226, 228, 230, 232, 234, 236, 238, 240, 242, 244, 246, 248, 250, 252, 254, 256, 258, 260, 262, 264, 266, 268, 270, 272, 274, 276, 278, 280, 282, 284, 286, 288, 290, 292, 294, 296, 298, 300, 302, 304, 306, 308, 310, 312, 314, 316, 318, 320, 322, 324, 326, 328, 330, 332, 334, 336, 338, 340, 342, 344, 346, 348, 350, 352, 354, 356, 358, 360, 362, 364, 366, 368, 370, 372, 374, 376, 378, 380, 382, 384, 386, 388, 390, 392, 394, 396, 398, 400, 402, 404, 406, 408, 410, 412, 414, 416, 418, 420, 422, 424, 426, 428, 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In these categories, we offer industry's broadest line of products designed for basic connector problems in the electrical/electronic fields. Available in every shape and size, and covering the entire spread of industry used wire size ranges, our terminals not only meet but in many cases actually exceed the most stringent commercial and military specifications. They are available in un-insulated and pre-insulated types, in sensitive base materials and in a complete selection of platings ranging from the most common to precious metals. All of them offer the advantages that go with our matched tool and terminal crimping technique—high resistance to corrosion, shock and vibration and superior conductive ability.

All of the above features can also be ascribed to our line of

splices. Again, these are available in both un-insulated and pre-insulated types for the entire range of most commonly used wire sizes. The line also includes specially designed splices which are highly resistant to adverse environmental factors such as moisture or extremes of heat and cold.

From computers to power stations, in ground control vehicles, boats and in super sonic aircraft, in the whole range of consumer oriented products, wherever a wire must be terminated to complete a circuit or in any manner affect the workings of an electrical or electronic function, you'll find AMP Terminals and Splices. Industry proved, over the years, they offer superior performance and long-lasting reliability at the lowest possible installed cost.



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Our research and testing facilities have always played a very important part in the improvement of existing products and the creation and development of new products. From the very beginnings, our concern with reliability and quality has motivated itself in considerable expenditure and effort and facilities owned to come in the industry. Continuing programs in research have been responsible for the development of new platings and plating techniques designed for today's refined and complex equipments. Out of this activity has come an X-ray technique for measuring metal thicknesses which helps control platings to one and one-half of an inch. In our research and testing activities, continuing study is being given to the effects of vibration on electrical connections.

In our Testing Laboratory, the very latest equipment is employed to subject all products, existing and in the making, to thorough and rigorous testing under all conditions with the result that in many instances the findings have been adopted as standards by both commercial and military agencies served by the industry.

In keeping with the reliability demands of our Space Age technology, this facility includes four "cold rooms" for the ultra-refined testing of electrical/electronic connectors and components.



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## Aeroquip Quality Products Simplify



**Aeroquip 101 Hydraulic Hose and reusable "Nipple" fitting.** Fits 1/2 to 1 1/2 inch hose. Temperature range -40° to +250°F. Hose size 3 to 24. Fittings in steel for 1/2 to 1 1/2 inch and 1/2 to 1 1/2 inch. Catalog 101.



**Aeroquip 102 and 101 Hose of Teflon and reusable "Nipple" fitting.** Fits 1/2 to 1 1/2 inch hose. Temperature range -40° to +250°F. Hose size 3 to 24. Fittings in steel for 1/2 to 1 1/2 inch and 1/2 to 1 1/2 inch. Catalog 102.



**Aeroquip 103 Hose of Teflon and reusable "Nipple" fitting.** Fits 1/2 to 1 1/2 inch hose. Temperature range -40° to +250°F. Hose size 3 to 24. Fittings in steel for 1/2 to 1 1/2 inch and 1/2 to 1 1/2 inch. Catalog 103.



**Aeroquip 104 and 103 Hose and reusable fitting for 1/2 to 1 1/2 inch hose. Temperature range -40° to +250°F. Hose size 3 to 24. Fittings in steel for 1/2 to 1 1/2 inch and 1/2 to 1 1/2 inch. Catalog 104.**



**Aeroquip 105 Hose and reusable fitting for 1/2 to 1 1/2 inch hose. Temperature range -40° to +250°F. Hose size 3 to 24. Fittings in steel for 1/2 to 1 1/2 inch and 1/2 to 1 1/2 inch. Catalog 105.**



**Aeroquip 106 Hose and reusable fitting for 1/2 to 1 1/2 inch hose. Temperature range -40° to +250°F. Hose size 3 to 24. Fittings in steel for 1/2 to 1 1/2 inch and 1/2 to 1 1/2 inch. Catalog 106.**



**Aeroquip 107 High Pressure Hose and reusable fitting for 1/2 to 1 1/2 inch hose. Temperature range -40° to +250°F. Hose size 3 to 24. Fittings in steel for 1/2 to 1 1/2 inch and 1/2 to 1 1/2 inch. Catalog 107.**



**Aeroquip 108 Hose of Teflon with Super-6 pressure rating.** Fits 1/2 to 1 1/2 inch hose. Temperature range -40° to +250°F. Hose size 3 to 24. Fittings in steel for 1/2 to 1 1/2 inch and 1/2 to 1 1/2 inch. Catalog 108.



**Aeroquip 109 Hose of Teflon with Super-6 pressure rating.** Fits 1/2 to 1 1/2 inch hose. Temperature range -40° to +250°F. Hose size 3 to 24. Fittings in steel for 1/2 to 1 1/2 inch and 1/2 to 1 1/2 inch. Catalog 109.



**Aeroquip 110 High Pressure Hose and reusable fitting for 1/2 to 1 1/2 inch hose. Temperature range -40° to +250°F. Hose size 3 to 24. Fittings in steel for 1/2 to 1 1/2 inch and 1/2 to 1 1/2 inch. Catalog 110.**



**The Aeroquip 111 Series Quick Disconnect Coupling.** Fits 1/2 to 1 1/2 inch hose. Temperature range -40° to +250°F. Hose size 3 to 24. Fittings in steel for 1/2 to 1 1/2 inch and 1/2 to 1 1/2 inch. Catalog 111.



**Aeroquip 112 Series Quick Disconnect Coupling.** Fits 1/2 to 1 1/2 inch hose. Temperature range -40° to +250°F. Hose size 3 to 24. Fittings in steel for 1/2 to 1 1/2 inch and 1/2 to 1 1/2 inch. Catalog 112.

\*Aeroquip 101 Fitting U.S. Patent Nos. 2,713,367 and 2,713,373

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ance data. We have a wealth of such data at United States Steel, plus comparative design studies, that will make your material problems easier. Ask for a USS cryogenics specialist by calling our nearest sales office, or writing United States Steel, Room 6834, 525 William Penn Place, Pittsburgh, Pennsylvania 15230.



9% nickel steel weld joint, showing the weld metal and the heat-affected zone. The weld metal is 9% nickel steel, and the heat-affected zone is 1% nickel steel.

## USS 9% Nickel Steel: excellent strength and notch toughness down to -320F

Developed, tested, and proven for cryogenic service, 9% nickel steel offers a rare combination of high yield strength, toughness, and notchability. It is particularly suited for large-volume cryogenic pressure equipment and has the transportation and storage of liquid cryogenics, oxygen, nitrogen, and argon. Because it doesn't require stress relief after fabrication or post-weld heat treatment, it is a natural for large field-welded tanks and vessels.

The ASME allowable working stress at 26,250 psi (Code Case 3586) is more than double that of 18,000 psi permitted for the standard alloy 5083. Plate thickness can be reduced to less than half those of aluminum with reversible refrigeration on wet per square foot.

Where strength is vital, 9% nickel steel is a natural alternative for aluminum. In case of fabrication, it offers independent savings, data accumulated to date suggest savings of at least 10% of fixed overhead cost compared to aluminum vessels.



31% nickel steel weld joint, showing the weld metal and the heat-affected zone. The weld metal is 31% nickel steel, and the heat-affected zone is 1% nickel steel.

## USS 31% Nickel Steel: used for land-based facilities and ocean-going tankers

Low carbon 31% nickel steel has been used for land-based facilities for the containment of liquid propane, carbon dioxide, acetylene, and ethylene. It is also used for large-volume cryogenic pressure equipment and has the transportation and storage of liquid cryogenics, oxygen, nitrogen, and argon. Because it doesn't require stress relief after fabrication or post-weld heat treatment, it is a natural for large field-welded tanks and vessels.

The ASME allowable working stress at 26,250 psi (Code Case 3586) is more than double that of 18,000 psi permitted for the standard alloy 5083. Plate thickness can be reduced to less than half those of aluminum with reversible refrigeration on wet per square foot.



Type 304 stainless steel weld joint, showing the weld metal and the heat-affected zone. The weld metal is Type 304 stainless steel, and the heat-affected zone is Type 304 stainless steel.

## USS Type 304 Stainless Steel: the #1 cryogenic metal down to absolute zero

The stainless-steel cryogenic metal standards, 304 and 304L, are by far the most popular metals for cryogenic service down to -450F. They are used widely in liquid oxygen production and storage, and the storage of liquid hydrogen and liquid helium. Wherever high purity is essential, such as handling liquid neon, krypton, xenon, or argon, the stainless steel is used because it is chemically clean and won't react.

Type 304 stainless steel is easy to weld and fabricate, doesn't require stress relief after fabrication, and provides high strength with excellent ductility and shock resistance at very low temperatures. Its allowable design stress is 18,750 psi.

304 and 304L are available in various grades.



**United States Steel**



### Greater EFFICIENCY

TYP. MODELS	Rated Torque (lb-in)	Rated Speed (rpm)	Efficiency (%)	Power Factor (%)	Insulation Class	Weight (lb)
ADH-100-34	25	148	118	95	15	0.005
ADH-100-36	25	120	118	95	15	0.005
ADH-100-38	25	100	118	95	15	0.005
ADH-100-40	25	80	118	95	15	0.005
ADH-100-42	25	60	118	95	15	0.005
ADH-100-44	25	40	118	95	15	0.005

Based on IEC A.P. 100

CPPC's new Design Range motor family provides the compatibility of efficiency and a three phase speed range. Efficiency up to 95% and speed up to 1500 rpm are available. The improved design also has improved thermal stability and improved thermal stability. The improved design also has improved thermal stability and improved thermal stability.

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### Higher TORQUE/INERTIA RATIO

TYP. MODELS	Rated Torque (lb-in)	Rated Speed (rpm)	Weight (lb)	Weight (lb)	Weight (lb)
ADH-100-34	25	148	0.005	0.005	0.005
ADH-100-36	25	120	0.005	0.005	0.005
ADH-100-38	25	100	0.005	0.005	0.005
ADH-100-40	25	80	0.005	0.005	0.005
ADH-100-42	25	60	0.005	0.005	0.005
ADH-100-44	25	40	0.005	0.005	0.005

Based on IEC A.P. 100

CPPC's new Design Range motor family provides the compatibility of efficiency and a three phase speed range. Efficiency up to 95% and speed up to 1500 rpm are available. The improved design also has improved thermal stability and improved thermal stability. The improved design also has improved thermal stability and improved thermal stability.

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### Lower STARTING VOLTAGE

CPPC's new Design Range motor family provides the compatibility of efficiency and a three phase speed range. Efficiency up to 95% and speed up to 1500 rpm are available. The improved design also has improved thermal stability and improved thermal stability. The improved design also has improved thermal stability and improved thermal stability.

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CPPC's new Design Range motor family provides the compatibility of efficiency and a three phase speed range. Efficiency up to 95% and speed up to 1500 rpm are available. The improved design also has improved thermal stability and improved thermal stability. The improved design also has improved thermal stability and improved thermal stability.

### Less heat vulnerable MATERIALS

CPPC's new Design Range motor family provides the compatibility of efficiency and a three phase speed range. Efficiency up to 95% and speed up to 1500 rpm are available. The improved design also has improved thermal stability and improved thermal stability. The improved design also has improved thermal stability and improved thermal stability.

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... EXTREMELY CLEAN, SOUND AND FINE GRAINED, WITH GOOD  
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Chemical analysis: C—0.45%, Mn—70%, Cr—15%, Ni—73%, Ti—2.50%, Al—80%, Co—65%, Fe—6.70%.

Other Firth Sterling high temperature alloys produced by the Hopkin's process include Grades LG-25 & Inconel, Inco 617, FS-600, FS-718, FS-901, A-286, M-252, V-17.

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TEMPERATURE	1000°F	1500°F
TENSILE STRENGTH	100,000	75,000
YIELD STRENGTH	100,000	75,000
ELONGATION	10%	20%
REDUCTION OF AREA	10%	20%

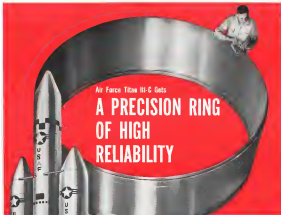
\*Test data developed from 3 to 1 inch diameter specimens directly from hot-chamber cast, with secondary test significantly better.

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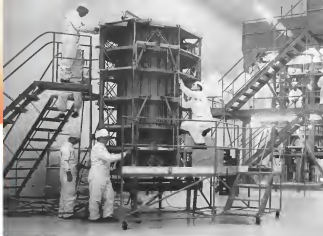


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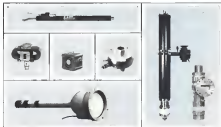
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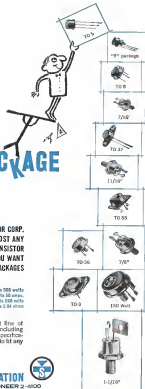
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Alcoa was there because it was the leader in industry to employ ultrasonic inspection methods, having started in 1945. Under John's direction, 73 units are now in service at Alcoa facilities producing ingot, forgings, plate and extrusions. Result? Flaws which had formerly enjoyed the privacy of nondetection can now be identified. This gives Alcoa the information needed to improve manufacturing techniques and furnish products of higher integrity. This, in turn, lowers manufacturing costs for customers.

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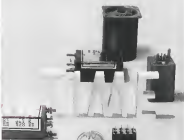
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Never before in the history of solar science have so many details of our status been under study. Spectrolab is justifiably proud of its participation in many of the research programs scheduled for 1964, the centennial year of the International Quiet Sun Year (IQSV). An extraordinary solar year by the time the next 18-year sun spot cycle is completed, our men will be on the moon, if our experimental data prove valid.

Spectrolab products fall into five separate, but interrelated, areas: Satellite power systems, solar systems, optical components, narrow bandpass filters, and rocket instruments all have one thing in common—they help to learn more about our sun.

Solar simulators at Spectrolab are big business. Under way right now is the final assembly of three large solar simulators to be used in conjunction with various chambers for the testing of satellite components and structures. And at the same time, the Spectromat Model X-20 Solar Simulator, a new laboratory instrument, is being built on a production line. In yet another area, a research staff is developing a plasma arc-arcuated re-entry simulation.

In optical design and fabrication, Spectrolab has concentrated on developing its ability to take on jobs that other people have avoided. Large parabolic mirrors, reflective windows off-axis mirrors, and deep aspheric lenses, are typical products. Metal mirrors, made by electro forming techniques, are in regular production.

Spectrolab multilayer dielectric filters are used throughout the world for laboratory and field experiments in solar physics. Most recently, a selected group of filters was combined with the Spectrolab Model BD-100 Rocket Photometer System for a high altitude solar energy measurement probe. Other new developments include ultra-narrow bandpass filters (1.5-2 Å) for laser applications.

For more information on these programs and other activities of Spectrolab, contact Spectrolab, Field Engineering Department, 21844 Gladstone Avenue, Sylmar, California.



SOLAR POWER BY SPECTROLAB

Orbiting satellites need a reliable means of gathering solar power to transmit their valuable data back home and make as much use of it as possible. One of the most important means is using programs like Spectrolab solar cell arrays and solar battery power systems. NASA's Orbital Advanced Development (OAD) will take its long "look east" with the assistance of Spectrolab solar cell arrays. The OAD will be in order of use at the Spectrolab Advanced Development Center in Pasadena, California. Spectrolab has fabricated auxiliary power systems using solar cells and a lead cell for important missions in the last three years alone.

More than just meeting jobs, Spectrolab designs to the ultimate in environmental reliability. Each high quality solar cell used is selected from its neighbors—ensured to stay on the specially designed lightweight substrate. Exclusive features such as Goldleaf® oxide and Goldleaf® optically coated filter glass add to the performance and reliability of the solar cell panel. Potential assembly problems provide a new string of production speed testing results for almost in even the most adverse circumstances.

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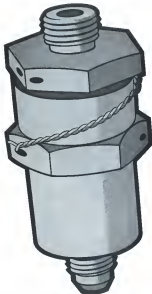












## FUEL AND COOLING SYSTEMS HAVE A GOOD THING IN COMMON...FILTERS LIKE THIS

Hydraulic-lubricating systems do, too. It's an in-line filter by Air-Maze, used for everything from anhydrous ammonia and hot gas to MIL-L 7808. Lightweight designs for all capacity requirements and pressures up to 3,000 psi. We build fluid filters for every aircraft and missile application, standard or special. We'll build them to your basic design, using the filter element you specify (pleated—disc—cylindrical—all metal construction) with the filtration you require. For detailed information, write or call Rockwell-Standard Corporation, Air-Maze Division, Cleveland 28, Ohio.



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# NEW



## HIGH TENSION CONTROLLED INTERFERENCE TAPER-LOK® FASTENERS



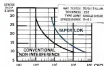
### WHY

are MS 23250, MS 2050, NAS 144 thru 156 & NAS 624 thru 636 series bolts being replaced with the NEW TL 400 Series TAPER-LOK fasteners?

### BECAUSE

The high-strength TL 400 series TAPER-LOK fasteners not only meet the full strength requirements of MIL-B 8831, they also offer the added **proven advantages** of the TAPER-LOK System including:

- **VALUABLE WEIGHT SAVINGS** up to 20%
- **RIGID STRUCTURAL INTEGRITY** through the positive controlled interference fit
- **BUILT IN QUALITY CONTROL** with close tolerance precision drilling at no added cost.
- **POSITIVE SEALING** without the use of supplementary sealants
- **PHENOMENAL STRUCTURAL FATIGUE LIFE** as proven by over \$1,000,000.00 in testing by major aircraft producers.



This SN diagram illustrates the fatigue life improvement realized through the use of the TAPER-LOK controlled interference fastener in a typical wing shear lap joint. (Fatigue improvement realized in other configurations.)

- Fasteners in joints of tensile load up to 200% improvement
- Fasteners in joints of compressive load up to 300% improvement



- **MAINTAIN** high strength 13 POINT HARDENING with heat treating, with finish (OPTIC WISHER)



ENGINEERED, MANUFACTURED & SOLD BY

## BRILES MANUFACTURING

1420 EAST GRAND AVENUE • EL SEGUNDO, CALIFORNIA

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